

Listing of the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claims 1-27. (Cancelled)

28. (Currently Amended) An apparatus, comprising:

a housing;

a sphere positioned in the housing, the sphere being rotatable in at least one rotary degree of freedom without requiring movement of the housing, wherein the sphere rotates in response to a user's digit directly contacting and manipulating the sphere;

a sensor coupled to the housing and configured to output sensor signals associated with a rotation of the sphere in the at least one rotary degree of freedom by the user's direct contact; and

an actuator coupled to the housing and configured to output haptic feedback to the sphere, the haptic feedback being a force applied the actuator orthogonally to a surface of the sphere, the haptic feedback being based on the sensor signals.

29. (Previously Presented) The apparatus of claim 28, further comprising an inertial mass coupled to the actuator, the actuator and the inertial mass collectively configured to output the haptic feedback, the haptic feedback being an inertial haptic feedback.

30. (Previously Presented) The apparatus of claim 28, wherein the haptic feedback is associated with a graphical representation displayed by a graphical user interface, a position of the sphere in the at least one rotary degree of freedom being associated with data values of a position of a cursor displayed in the graphical user interface.

31. (Previously Presented) The apparatus of claim 28, wherein the haptic feedback is associated with a simulated interaction of a cursor and a simulated graphical object in a graphical user interface.

32. (Previously Presented) The apparatus of claim 28, wherein the haptic feedback is associated with data values associated with movement of a cursor between menu items in a displayed graphical menu.

33. (Previously Presented) The apparatus of claim 28, wherein the haptic feedback includes a force sensation, the force sensation being at least one of a pulse, a vibration, and a texture.

34. (Previously Presented) The apparatus of claim 28, wherein the haptic feedback is a vibrotactile haptic feedback that is provided by a moving element.

35. (Previously Presented) The apparatus of claim 34, wherein the moving element is a cover portion of the housing, the cover portion being movably coupled to a remaining portion of the housing.

36. (Previously Presented) The apparatus of claim 34, wherein the moving element is a button, the button being configured to provide input to a host computer.

37. (Previously Presented) The apparatus of claim 28, further comprising a microprocessor coupled to the sensor and the actuator, the microprocessor being configured to send haptic

feedback signals to the actuator based on host commands received from a host computer, the microprocessor further configured to send locative data to the host computer, the locative data being associated with the sensor signals and the movement of the sphere.

38. (Previously Presented) The apparatus of claim 28, wherein the actuator is configured to output the haptic feedback, the haptic feedback being associated with a command received from a host computer.

39. (Currently Amended) An apparatus, comprising:

a housing;

a sphere positioned in the housing, the sphere being rotatable in at least one rotary degree of freedom without requiring movement of the housing, wherein the sphere rotates in response to a user's digit directly contacting and manipulating the sphere;

a sensor coupled to the housing and configured to output sensor signals associated with a rotation of the sphere in the at least one rotary degree of freedom by the user's direct contact; and

an actuator coupled to the housing, the actuator being configured to output haptic feedback to the sphere, wherein the haptic feedback does not resist or assist movement of the sphere as the sphere is moved; and

at least one compliant element coupled to the housing and the actuator, the at least one compliant element being configured to amplify the haptic feedback.

40. (Previously Presented) The apparatus of claim 39, wherein the at least one compliant element includes a compliant coupling between the housing and a support for the housing.

41. (Previously Presented) The apparatus of claim 39, wherein at least a portion of the sphere extends from the housing, the haptic feedback being output approximately along an axis substantially normal to a point of the sphere.
42. (Previously Presented) The apparatus of claim 39, wherein the haptic feedback is associated with a simulated interaction of a cursor with a simulated graphical object displayed in a graphical environment.
43. (Previously Presented) The apparatus of claim 39, further comprising an inertial mass coupled to the actuator, the actuator and the inertial mass collectively configured to output the haptic feedback, the haptic feedback being an inertial haptic feedback.
44. (Previously Presented) The apparatus of claim 43, further comprising a flexure member, the flexure member being configured to provide a centering spring force to the inertial mass.
45. (Previously Presented) The apparatus of claim 39, wherein the haptic feedback is a vibrotactile force, the actuator being configured to drive a moving element.
46. (Previously Presented) The apparatus of claim 39, further comprising a microprocessor coupled to the sensor and the actuator, the microprocessor being configured to output haptic feedback signals to the actuator based on host commands received from a host computer, the microprocessor further being configured to send locative data to the host computer, the locative data being associated with the sensor signals and the movement of the sphere.

47. (Previously Presented) The apparatus of claim 39, the actuator being a first actuator, the apparatus further comprising a second actuator configured to output a second haptic feedback in the at least one rotary degree of freedom.

48. (Previously Presented) The apparatus of claim 47, wherein said second actuator is a passive brake configured to provide a resistance to rotation of the sphere.

49. (Currently Cancelled)

50. (Previously Presented) The method of claim 62, wherein the haptic feedback is output in response to a movement of an inertial mass coupled to an actuator.

51. (Currently Amended) An apparatus, comprising:

a sphere positioned within a housing and moveable in at least one rotary degree of freedom;

a sensor configured to output sensor signals associated with a movement of the sphere in the rotary degree of freedom by directly contacting the sphere via a user's digit, wherein rotation of the sphere occurs without movement of the housing; and

an actuator configured to output haptic feedback to the sphere, the haptic feedback including a force applied by the actuator in a direction perpendicular to the surface to the sphere, the haptic feedback being based on the sensor signals.

52. (Previously Presented) The apparatus of claim 51, further comprising an inertial mass coupled to the actuator, the actuator and the inertial mass collectively configured to output the haptic feedback, the haptic feedback being an inertial haptic feedback.
53. (Previously Presented) The apparatus of claim 51, wherein the haptic feedback is associated with a graphical representation displayed by a graphical user interface, a position of the sphere in the at least one rotary degree of freedom being associated with data values of a position of a cursor displayed in the graphical user interface.
54. (Previously Presented) The apparatus of claim 51, wherein the haptic feedback is associated with a simulated interaction of a cursor and a simulated graphical object in a graphical user interface.
55. (Previously Presented) The apparatus of claim 51, wherein the haptic feedback is associated with data values associated with movement of a cursor between menu items in a displayed graphical menu.
56. (Previously Presented) The apparatus of claim 51, wherein the haptic feedback includes a force sensation, the force sensation being at least one of a pulse, a vibration, and a texture.
57. (Previously Presented) The apparatus of claim 51, wherein the haptic feedback is a vibrotactile haptic feedback that is provided by a moving element.

58. (Previously Presented) The apparatus of claim 57, wherein the moving element is a cover portion of the housing, the cover portion being movably coupled to a remaining portion of the housing.

59. (Previously Presented) The apparatus of claim 57, wherein the moving element is a button, the button being configured to provide input to a host computer.

60. (Previously Presented) The apparatus of claim 51, further comprising a microprocessor coupled to the sensor and the actuator, the microprocessor being configured to send haptic feedback signals to the actuator based on host commands received from a host computer, the microprocessor further configured to send locative data to the host computer, the locative data being associated with the sensor signals and the movement of the sphere.

61. (Previously Presented) The apparatus of claim 51, wherein the actuator is configured to output the haptic feedback, the haptic feedback being associated with a command received from a host computer.

62. (Currently Amended) A method, comprising:

selecting a housing having a sphere therein, wherein the sphere is partially exposed from the housing;

rotating the sphere by directly contacting the sphere using a digit, wherein rotation of the sphere does not cause movement of the housing;

generating a sensor signal via a sensor wherein the sensor signal causes a simulated interaction or event in a graphical environment on a display in response to said rotation; and

outputting a haptic feedback force onto the sphere in a direction orthogonal to the rotation of the sphere from an actuator in response to said simulated interaction or event in said graphical environment.